SCIENCE.

FRIDAY, NOVEMBER 21, 1884.

COMMENT AND CRITICISM.

We often hear it said, that any thing is easy to do when one only knows how; but the transition from doing to speculating involves in some way the inverse of this; for what is easier than unending conjecture to the wilfully ignorant theorizer? Astronomers and physicists, armed with powerful telescopes and spectroscopes, have for years been assiduously occupied with the careful and systematic study of all the visible phenomena of the solar disk, and have been able to obtain satisfactory solutions of many problems of great difficulty. For the pretentious pseudo-scientist, however, all these labors have been in vain. His own theories preclude all need of investigation, and the facts must be manipulated into coincidence with his vagaries. But there still remains a host of mysteries in the field of the physics of astronomy which all observation and reasonable hypothesis have so far failed to unravel. Do these harass the soul of the pseudo-scientist? Far from it. Not only is he ready to urge on every occasion 'the true theory,' and to prove that his is 'the only possible solution,' but he rashly confronts all existing science with unanswerable clinchers, in this wise: "Where, then, shall we turn for a theory, if we reject the one herein developed, . . . *the non-admission of which will forever involve science in difficulties and inconsistencies?*"

We have a doubt whether we do not owe our readers an apology for space given up to such a book as that noticed in another column of this issue; but it gives us excuse for correcting the impression, more or less prevalent among those indirectly interested in the progress of American science, that the crop of pseudo-scientific literature is larger in our own country than it is abroad. The scientific 'crank,' like all of that ilk, is perpetually clamoring for recognition; and, as he ever and anon acts upon his belief that the acknowledged leaders in science are most easily accessible through their mails, this impression is speedily corrected on examination of the sources of the contents of a few waste-baskets. The more thorough and wide-spread scientific education afforded in many foreign countries is not apparently, as we should expect, the means of turning the energies of the 'crank' into the direction of legitimate research; but he enjoys his frequent appearance in type with a freedom which the American pseudo-scientist only rarely indulges.

We may take this occasion to comment further on the very unwise precedent which the publishers of this book have set by the issue of a work of this character. Book-publishing has for a number of years been conducted on a very scientific basis by a few of the better-known houses, and only such works have been issued as were able to pass muster with the critical 'reader' or expert. The greatest of care has been exercised, that the publication of no book should be undertaken the sales of which were not likely to be reasonably remunerative. Such care has greatly lessened the labors of large buyers of books, and inspired them with a very proper confidence in the best houses; so that, in fact, not a few libraries have standing orders with certain publishers for every book as soon as issued, and the book-buyer has heretofore been usually safe against serious imposition. When, however, an accumulation of literary refuse comes on the market, bearing the imprint of a reputable house, it becomes an appropriate season for the display of cautionary signals.

The *Monthly weather-review* of the signal-service for last August shows an important

change in the right direction on its cover. Heretofore these valuable summaries, involving a great amount of labor quite apart from the preparation of daily forecasts, have been issued anonymously; at least, it has been simply announced that they were "prepared under the direction of . . . the chief signal-officer of the army." There is now very properly added to this the name of the officer personally in charge of the work. The more direct the statement of individual authorship, the better; for with it goes individual credit and responsibility. The 'Professional papers' and the 'Notes of the signal-service' have always been thus duly credited to their authors: it would be well if the authorship of the many circulars that have been issued on tornadoes, thunder-storms, and other subjects, had been as explicitly published.

The terminology of storms adopted in these reviews is somewhat open to criticism. After forty years of observation, during which it has always been found that regions of low barometric pressure are accompanied by an inward flow of the winds, with a constant direction of spiral turning, it does not seem hasty to use a *name* for such phenomena, and call them briefly 'cyclones,' as was long ago suggested, so as to avoid the awkward paraphrase, 'area of low barometer,' on the one hand, and the abrupt slangy expression, 'low,' on the other, and do away with so erroneous a description as 'atmospheric depression,' and with so indefinite a term as 'disturbance.' It is an incorrect use of the word that associates cyclones only with hurricanes of devastating strength, or with local storms like tornadoes. It was originally proposed, and should still be used, to designate a certain kind of atmospheric mechanism, independent of gentleness or violence, and hence perfectly applicable to the 'disturbances' in question.

Redfield was clearly of this opinion. In 1854 he wrote that the term 'cyclone' was proposed "to designate any considerable area or extent of wind which exhibits a turning or revolving motion, without regard to its varying velocity, or to the different names which are often applied to such winds. . . . All hurricanes or violent storms may, perhaps, be considered as cyclones or revolving winds; but it by no means follows that all cyclones are either hurricanes, gales, or storms." He said, further, that the word was not designed to express the degree of activity or force of the wind, and made mention of "the inert and passive cyclones which seldom gain attention." Similar abstracts could be made from Col. Reid's famous work on the 'Law of storms;' and, even in the early numbers of the *Weather-review*, 'cyclone' was used in its original sense. It would be advisable to return to it.

By means of a most promising local anæsthetic, Dr. Koller of Vienna has recently been able to render the eye quite insensible to pain. Under its influence, almost any operation may be performed upon this delicate organ without causing suffering; and its use is not followed by unpleasant after-effects. A few minutes after putting three or four drops of a four-per-cent solution of hydrochlorate of cocaine into the eye, no discomfort is felt when the front of the eyeball is rubbed with the finger; or it may be cut with a knife, for example, to do an operation for cataract, and no pain is occasioned. It is not many weeks since this was demonstrated in Germany; and already many operations have been performed by our own oculists with great success and satisfaction. For some months before its use in the eye, it had been employed by physicians to render the mucous membranes less sensitive, especially that of the throat; and it will probably be found capable of rendering other valuable services in medicine.

The alkaloid cocaine, which was isolated about thirty years ago by Gardeke, and is somewhat similar to the one which is found in tea and coffee, is obtained from the leaves of the Erythroxylon coca. This shrub is cultivated in the valleys of the eastern slopes of

the Andes; and its leaves, which are gathered and dried with great care, have been used by the natives as a stimulant and narcotic since the days of the Incas, by whom it was held in great esteem. This plant should not be confounded with the more familiar Theobroma cacao, the seeds of which afford chocolate and cacao-butter, nor with the cocoanut, whose tree supplies food, drink, light, clothing, and shelter to the natives of some tropical lands.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The stone age in prehistoric archeology.

IN a recent number of *Science*, it is stated (p. 438), that at a meeting of the Academy of natural sciences of Philadelphia, Sept. 25, Dr. Brinton exhibited certain stone objects from Tunis, presented by the Marquis de Nadaillac. Among them was one resembling the 'stemmed scrapers' found in this country. "This form," the writer goes on to state, "is characteristic, in France, of the *later* productions of the stone age, especially of that epoch called by the French archeologists 'the epoch of Robenhausen.' Chronologically, this is regarded as the first epoch of the appearance of man on the globe, the previous implement-using animals being probably anthropoids." This is a most amazing travesty of the views of de Mortillet and the archeologists of his school. It may safely be asserted that no one holds any such opinions as these, with the possible exception of the writer of the notice in question.

At the Prehistoric congress held at Brussels in 1872, Gabriel de Mortillet first proposed his system of classification of the age of stone. In it the name 'epoch of Robenhausen' is given as synonymous with 'age of polished stone,' or 'neolithic period;' while the paleolithic age is subdivided into four grand divisions, called, in the inverse order of their antiquity, those of La Madelaine, of Solutré, of Moustier, and of St. Acheul, each characterized by its own peculiar type of instrument. This classification was still further extended by him to the age of bronze, in a table exhibited at the Geographical congress held at Paris in the summer of 1875. A full account of it was given in the *Matériaux*, vol. x. p. 372. Since then the system has been almost universally adopted by prehistoric archeologists; and it is thoroughly explained and admirably illustrated in the 'Musée préhistorique,' published by Messrs. Gabriel and Adrien de Mortillet, in 1881. In 1883 the elder de Mortillet published, in the library of contemporary sciences, his 'Le préhistorique antiquité de l'homme.' In this the views he was known to hold in regard to the so-called 'tertiary man,' or, as he more logically entitles him, 'the precursor of man,' are set forth in detail. A critical notice of this work was given by the writer in *Science* for March 30, 1883. The work is divided into three parts, — 'the tertiary man,' 'the quaternary man,' and 'the man of the present' (*homme actuel*); and the doctrine is maintained that "it is only at *the commencement of the quaternary* that man shows himself not absolutely identical with us, but so near that we cannot refuse to him, under a proper nomenclature, the name of man." De Mortillet's peculiar views, with which only a very few anthropologists sympathize, are confined to the existence of an intelligent 'implement-using anthropoid' in tertiary times. To this question he returns with renewed vigor in his journal, *L'homme*, of the 25th of last September, apropos of the excavations made at the celebrated locality of Thenay (near Tours) by a committee of the French association for the advancement of science. These were preparatory to a discussion of the question of the tertiary man at the meeting held last year at Blois.

Whether it was 'man,' or 'an intelligent anthropoid,' who fabricated stone implements in tertiary times, may well be a question; but there is no doubt whatsoever that they were men very like those first found by Europeans on this continent, and Mr. Jacob Messikommer will help any one, as he did the writer, to disinter their relics from the peat-moor of Robenhausen.

HENRY W. HAYNES.

Boston, Nov. 10.

Forgotten conclusions of science.

Your comments on the forgotten conclusion of an investigator on rectal anaesthesia reminds me of a discussion, in the section of physics at the American association, over a paper of Professor Graham Bell's, on a possible method of communication between ships at sea. Several eminent men and some distinguished foreign visitors took part in the discussion. It led out into suggestions of telegraphing across the ocean without wires, and experiments of communication across rivers, and across the strait between Southampton and the Isle of Wight.

As my recollection serves me, Professor Morse went over all these experiments more than thirty years ago, and supposed at one time he could carry his telegraph across rivers and streams by means of two wires, one running up and the other down stream along the shores, and then dipping into the water. I remember seeing a cut illustrating it. Professor Bell's paper was a new adaptation of the old idea; but the discussion, and all, seemed to me to be wholly oblivious of the experiments and conclusions of Professor Morse.

P. J. FARNSWORTH.

Clinton, Io., Nov. 8.

The lamprey as a builder.

During the month of June I had an excellent opportunity to observe the manner in which the lamprey eel (Petromyzon marinus) builds a stone dam for the deposit of spawn and for the protection of the progeny.

The location of the structure was in the Saco River, within the ripples near the foot of the lower falls, three miles from the sea, and near the level of mean high water. It was nearly at right angles with a shore-wall of granite, and was about fifteen feet long and from one to three feet in height. Its position and triangular shape in vertical section were well adapted for securing a change of water, and a hiding-place among the stones for the young.

When I first noticed the movements of the eels, they were diligently at work, their system of operation being very methodical; but I was not able to determine whether there was any action by single pairs, as

their movements were rapid, and the number engaged at one time must have been fifty, while it is probable that a hundred were at work, for they were constantly coming from various directions to take or resume their places on the up-stream side of the dam.

The river-bed at this point was made up of water-worn stones, chips of granite, and fragments of bricks, over which there was a steady flow of water, the depth being four or five feet, but varying with the level of the tide.

The mode of raising the material was the same in all cases: the eel attached his mouth to a stone, and then, with many wrigglings and contortions (the head always pointing up-stream), lifted it from the bottom; he then backed down stream, floating with the current, until the stone was over the centre of the heap, when it was dropped, lodging sometimes on one side, and sometimes on the other. He then usually returned for more material to the deep and comparatively still pool formed above the dam by the previous excavations, but in some instances was unable to stem the more rapid current at the top of the dam, and was carried below it. When this happened, he swam around the outer end of the dam, and returned to the pool to resume the work.

I noticed in many instances that the heavier stones were lifted by two eels, working alongside of each other, and carried to their proper places in the structure. Half-bricks, weighing two pounds, were thus transported by one individual, and many of the stones were of much greater weight.

Later in the season many of the eels were lying quietly upon the up-stream side of the dam, and about the middle of July all had disappeared.

The temperature of the water, when the river-current was not met by the tide, was in June about 64° F., and in July 71°.

Stones of various sizes, lying at the base of the shore-wall, were removed; and it was evident that the stability of this wall would have been impaired if it had been built upon a rubble or gravel foundation instead of upon a solid ledge.

John M. Batchelder.

Cambridge.

A viviparous pumpkin.

To-day, on cutting open a common pumpkin fresh from the field and perfectly sound, it was discovered that very many of the seeds had already germinated. The caulicles were from one to three inches in length, while some of the rootlets were over seven inches. The cotyledons, wherever free from the seed-covering, were green in color, and spread so as to expose the growing plumule. In one case the second leaves were partly unfolded. E. T. Nelson.

Delaware, O., Nov. 1.

American pearls.

In answer to George F. Kunz in No. 89, let me say that many pearls, ranging from five to twenty-five or more dollars in value, have been found in the fresh-water mussel in the Little Miami River, a few miles from here. The prevailing color is pink, in various shades. In size they vary, the larger ones being about as large as a pea, or larger. The pearls have been found at various times, from a dozen years ago, up to last April. They are commonly found in the Unio, — U. undulatus, or U. occidens. R. N. Roark.

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FERDINAND VON HOCHSTETTER.

Ferdinand von Hochstetter was born at Esslingen (Wurtemberg), April 30, 1829, and died, after a painful illness of five years, at Vienna, on the 17th of last July. His father, a clergyman, was a well-known botanist, and a professor of natural history. While a pupil of the celebrated geologist and paleontologist, Prof. F. A. Quensted of Tübingen, Hochstteter was a classmate of the late A. Oppel, and is one of the most prominent of the geologists of the school to which science is indebted for such celebrated geologists and paleontologists as Oscar Fraas of Stuttgart; C. Rominger of Ann Arbor, Mich.; A. Oppel, and Trautschold, of Moscow. When an assistant in the Austrian geological survey, he was appointed naturalist of the 'Novara expedition round the world,' 1857–59. After visiting Gibraltar, Rio de Janeiro, the Cape of Good Hope, St. Paul Island, the Nicobar Islands, and Java, Hochstetter left the Novara, shortly after its arrival at New Zealand, and passed almost the whole of 1859 in preparing a careful geological reconnoissance of the northern and southern islands of New Zealand. Scarcely had the Novara anchored at Auckland, before Julius von Haast, an Austrian nobleman of great ability, well known afterward as the director of the Canterbury museum of Christchurch, came on board. Haast had come out a short time before as a settler. Hochstetter at once secured him as his assistant; and after seven months in the northern island, and two months in the province of Nelson in the southern island, with the aid of the New-Zealand government and of the leading citizens of the colony, he succeeded in determining most satisfactorily the geology of this distant country, describing not only the beautiful volcanic formation, but also the secondary, the tertiary, and the quaternary formations, and adding much to our knowledge of geographical geology. The results of Hochstetter's researches were first given as lectures before the Auckland mechanics' institute, June, 1859, and at Nelson in October of the same year. The

New-Zealand government gazette published them, and a special copy was distributed in the colony and in England. Afterward, geological maps were added, and lectures and maps appeared at Auckland in 1864, under the title of 'The geology of New Zealand.' Later, Hochstetter published in Vienna, 1866, two quarto volumes, entitled 'Geologie und paläontologie von Neu Seeland,' the paleontology being worked up by such specialists as Unger, Zittel, Suess, Stoliczka, with the assistance of Hörnes, von Hauer, and Hochstetter himself. Shortly after his return to Vienna, in 1860, Hochstetter was appointed professor of geology and mineralogy at the imperial polytechnic school. In 1867 he was sent by the Austrian government to Paris as a commissioner to the International exhibition, and in 1874 he was assistant director of the Vienna international exhibition. Shortly after this, he was made director of the new imperial museum of natural history, with the difficult task of erecting a new building. Notwithstanding illness, which soon attacked him, Hochstetter had the happiness of seeing all the collections removed to the new building, and arranged so systematically that the Vienna museum now ranks among the first, if not the first, in the world. From 1869 to 1872, Hochstetter was exploring European Turkey, of which he prepared an excellent geological map, with a report. He afterwards visited the Ural Mountains, described in his 'Ueber den Ural,' Berlin, 1873. Hochstetter was also a geographer of note, and his 'Die erde' is justly popular. As vice-president, afterward president, of the geographical society of Vienna, he rendered important services to geography, more especially in assisting the expedition to the north pole, which resulted in the discovery of Franz-Josef Land, and in his continued aid to Dr. Oscar Lenz, the explorer of western Africa, and the traveller who made the remarkable journey from Tangier to Timbuctoo and the Senegal. Finally Hochstetter was selected, in 1872, by the emperor of Austria-Hungary as tutor in natural history to the crown prince.

Ferdinand v. Hochstetter

Personally, Ferdinand von Hochstetter was a most attractive man, a very interesting lecturer, and a powerful conversationalist. He married an English lady; and his house in Döbling, Vienna, was a centre for Austrian *savants*, and for all foreigners visiting the capital of the Austrian empire.

MARRIAGE LAW IN SAVAGERY.[1]

SOCIETY is organized for the regulation of conduct, and conduct is regulated by law in the

[1] See Certain principles of primitive law (*Science*, No. 92).

several stages of human progress in relation to those particulars about which serious disagreement arises. In the early history of mankind it appears, from all that we may now know of the matter, that the most serious and frequent disagreements arose out of the relations of the sexes. Men disagreed about women, and women about men. Early law, therefore, deals to a large extent with the relations of the sexes. The savage legislator sought to avoid controversy by regulating marital relations; and this he did by denying to the individual the right of choice, and providing that certain groups of men should take their wives from certain groups of women, and, further, that the selection of the woman should not be given to the man, nor the selection of the man to the woman, but that certain officers or elder persons should make the marriage contract. This method of selection will here be called legal appointment.

Now, selection by legal appointment exists among all North-American tribes, and elsewhere among savages in Australia and other portions of the globe: it exists in diverse forms, which may not here be recounted for want of space. But the essential principle is this: in order that controversy may be avoided, marriage selection is by legal appointment, and not by personal choice.

But the second fundamental principle of primitive law greatly modifies selection by legal appointment, and gives rise to three forms of marriage, which will be denominated as follows: first, marriage by elopement; second, marriage by capture; third, marriage by duel.

It very often happens in the history of tribes that certain of the kinship groups diminish in number, while others increase. A group of men may greatly increase in number, while the group of women from whom they are obliged to accept their wives diminishes. At the same time another group of women may be large in proportion to the group of men to whom they are destined. Under these circumstances, certain men have a right to many wives, while others have a right to but few. It is very natural that young men and young women should sometimes rebel against the law, and elope with each other. Now, a fundamental principle of early law is that controversy must end; and such termination is secured by a curious provision found among many, perhaps all, tribes. A day is established, sometimes once a moon, but usually once a year, at which certain classes of offences are forgiven. If, then, a runaway couple can escape to the forest, and live by themselves until the day of forgiveness, they may return to the tribe, and live in peace. Marriage by this form exists in many of the tribes of North America.

Again: the group of men whose marriage rights are curtailed by diminution of the stock into which they may marry, sometimes unite to capture a wife for one of their number from some other group. It must be distinctly understood that this capture is not from an alien tribe, but always from a group within the same tribe. The attempt at capture is resisted, and a conflict ensues. If the capture is successful, the marriage is thereafter considered legal; if unsuccessful, a second resort to capture in the particular case is not permitted, for controversy must end. When women are taken in war from alien tribes, they must be adopted into some clan within the capturing tribe, in order that they may become wives of the men of the tribe. When this is done, the captured women become by legal appointment the wives of men in the group having marital rights in the clan which has adopted them.

The third form is marriage by duel. When a young woman comes to marriageable age, it may happen that by legal appointment she is assigned to a man who already has a wife, while there may be some other young man in the tribe who is without a wife, because there is none for him in the group within which he may marry. It is then the right of the latter to challenge to combat the man who is entitled to more than one, and, if successful, he wins the woman; and by savage law controversy must then end.

All three of these forms are observed among the tribes of North America; and they are methods by which selection by legal appointment is developed into selection by personal choice. Sometimes these latter forms largely prevail; and they come to be regulated more and more, until at last they become mere forms, and personal choice prevails.

When personal choice thus prevails, the old regulation that a man may not marry within his own group still exists: and selection within that group is incest, which is always punished with great severity. The group of persons within which marriage is incest, is always a highly artificial group: hence, in early society, incest laws do not recognize physiologic conditions, but only social conditions.

The above outline will make clear the following statement, that endogamy and exogamy, as originally defined by McLennan, do not exist. Every savage man is exogamous with relation to the class or clan to which he may

belong, and he is to a certain extent endogamous in relation to the tribe to which he belongs, that is, he must marry within that tribe; but in all cases, if his marriage is the result of legal appointment, he is greatly restricted in his marriage rights, and the selection must be made within some limited group. Exogamy and endogamy, as thus defined, are integral parts of the same law, and the tribes of mankind cannot be classed in two great groups, one practising endogamy, and the other, exogamy.

The law of exogamy is universal. Among all peoples there is a group, larger or smaller, and natural or artificial, within which marriage is prohibited. The terms 'exogamy' and 'endogamy' are misleading, and should be discarded. J. W. POWELL.

A SCIENTIFIC STUDY OF LAWN-TENNIS.

LAWN-TENNIS is a game which has taken firm hold upon Americans, and is becoming more popular every year. It is claimed to possess the qualities which make a perfect game, being safe, healthful, not insuperably difficult, and alike interesting to 'duffer' and expert, provided the two are not matched. The use of the 'cut' and of slow returns having been given up for drives, volleying, and swift returns, it has ceased to possess the reproach once cast upon it of being a ladies' game, and is admitted to call forth science, skill, and endurance. Lawn-tennis puts upon its players a demand for muscular quickness and elasticity, great self-control, and a fine and peculiar development of the muscular sense.

It is by the help of this sense that the ball is returned with just the right force and in just the right direction, no matter how hard or how gently it strikes the bat; and in tennis the peculiarity lies in the fact that delicate muscular adjustments must be made at the same time that violent contractions of the muscles take place. The skilled artisan goes slowly and gently over his delicate work. The juggler performs his tricks with light and easily handled articles. The billiard-player has to use comparatively little force to make his brilliant strokes. The tennis-player, however, must be ready to strike hard or softly while gripping the racket, adjusting it at just the right angle, and driving it in just the right direction.

Man experiences a curious sensation of pleasure in thus developing and exercising his muscular sense. The delight felt over a good shot, a brilliant catch, an unexpected return, — all come in the main from this same source, which we might almost call the 'sporting sense.'

The physiology of muscular co-ordination has been much studied, but its relation to aesthetics is, perhaps, not as yet 'worked up:' therefore I will dwell upon this point a little.

Every phase and degree of muscular contraction registers itself in the brain; but when these contractions, in obedience to the will, effect a certain delicate, previously conceived result, a thrill of pleasure is felt, which is not wholly mental satisfaction over success; it is also an intensified muscular sensation. As the eye delights in beautiful colors, and the ear in sweet music, so the muscles rejoice in delicate adjustments. They have their own æsthetics: hence there have always been athletic sports, and hence even pugilism would have no charm if it were mere slugging.[1] The Greeks cultivated this sense as actively as that for poetry, sculpture, and architecture: we might do well to imitate them.

It is true that the muscular sense is not the only factor in measuring distance and adjusting muscular movements. The eye, the ear, and the tactile, more especially the pressure, sense, also come into play. But setting aside the zest of competition, the joys and sorrows of beating or being beaten, it is to certain sensory nerves, distributed through muscle and tendon, that we must attribute much of the pleasure got from athletic games. This may be shown in still another way. After the frequent repetition of a set of muscular contractions, the sensations excited thereby cease to rise into consciousness. Perhaps this is due, as Ribot suggests, in part to their increased number, and briefness of duration. At any rate, we know that a frequently repeated act of muscular skill finally comes to be done almost automatically and with little intervention of consciousness. So it is that with skilled players the minor and easy strokes of the game call out no new, complex, and delicate adjustments with the corresponding aesthetic excitement.

Every one who has ever attained any special skill in athletic games knows the pain and weariness of playing with the beginner. What hours of heroism in love's cause have been spent by old tennis-players in teaching the non-

[1] I am quite aware that some physiologists consider part of the muscular sensations to be central in origin (innervation feelings), starting up with the volitional impulse, and accompanying it, as it were, to the muscle. It is simply inconceivable, however, that we can be conscious of muscular contractions that have not yet been made.

co-ordinated musculature of fair young maidens to serve and return the ball! The reason is plain enough to the player; but, put in physiological terms, it supports the view I have suggested as to the aesthetic function of the muscular sense.

The muscular mass of the human system is a large one. It makes up forty per cent of the total bodily weight; and leaving out the skeleton, which has a mechanical function only, we are two-thirds muscle. Besides, it is supplied throughout with the nerves which excite it, and with sensory nerves, which notify the brain at once of use and misuse, sickness and health. There may be a fair state of health, but there can be no exuberant vigor, none of the lusty *joie de vie*, without perfectly nourished and perfectly functioning muscles. Thus, when over-used or poorly nourished, we have the sensations of fatigue, weariness, and *malaise*, such as are complained of by thousands of underfed and underworked persons. Furthermore, as the muscle retires, the nerve comes to the front, and we get our nervous women, who are the products, in large part, of insufficient or improper muscular exercise.

There are a few pathological facts in connection with lawn-tennis which may be briefly noted: —

Every new invention and every new sport has its accidents and diseases. For some time English medical journals have had letters about 'lawn-tennis arm,' 'lawn-tennis elbow,' and 'lawn-tennis leg.' The cause of these troubles is generally simple. 'Tennis arm' is caused by a rupture of some of the fibres of the *pronator radii teres*. The front of the fore-arm is tender, perhaps swollen, while pronation and flexion are difficult. In some forms of 'tennis arm' the musculo-spiral nerve, as it passes around the elbow, gets pinched and injured; then there is weakness in extension and in 'back-hand' strokes. In 'lawn-tennis wrist' the anterior part of the annular ligament is stretched, and there is probably a little inflammation of the grooves in which the flexor tendons run.

'Lawn-tennis leg' is due to rupture of some of the muscles of the calf in swift and powerful serving. The muscle ruptured is thought to be the *plantaris longus*.

These 'legs' and 'arms' are more apt to occur in middle age and among too ambitious beginners. They are not of frequent occurrence, and are not dangerous. Rest, rubber bandages, friction, and electricity are sure to bring about a cure.

C. L. Dana, M.D.

New York.

LATE NEWS FROM THE NORTH-WEST.

Late advices from Alaska state that the volcano on Augustine Island, Cook's Inlet, continues to show signs of activity by smoke, noises, and earthquake shocks of light intensity. About the time of the eruption last autumn, between the 23d of September and the 18th of October, eight shocks were felt at Port Etches, in Prince William Sound. At Kasiloff, on the eastern shore of Cook's Inlet, at the mouth of the river of the same name, on the 14th of November, 1883, a tidal wave flooded the salmon-canning establishment of Cutting & Co., and washed away a considerable strip of bluff along the shore for several miles.

Edward Langtry, one of the early explorers of the Lewis branch of the Yukon, in the Chilkat country, has been prospecting on the Kuskokwim and Nushagak Rivers during the past year, and intends to remain another season.

News from the explorers of the Copper or Atna River indicates that they were in July detained at a point where the river passes through a narrow cañon, and a glacier abuts upon it. This glacier, extending over the surface of the stream, nearly closed it to navigation, and an arrangement had just been completed with some of the natives, who were to assist the party to cross the glacier.

News has been received of the return of Lieut. Stoney from his explorations on the Kowak River, emptying into Hotham Inlet, Kotzebue Sound. He had ascended this river, which has been known for thirty years, but never surveyed, to a distance which he estimates at four hundred miles, which is probably meant to include all irregularities. He did not reach its source, as his instructions forbade him to winter there. He has forwarded a report to the Navy department. A party from the revenue-steamer Corwin has also ascended the river this season, and in 1881–82 Messrs. Jacobsen and Woolfe explored its course for some fifty miles. The former has just published at Leipzig an account of the journey under the editorial supervision of Dr. Woldt, a work which has not reached us. The following year Lieut. Stoney, furnished with a boat and party from the revenue-steamer Corwin, Capt. Healy, on which he was a passenger, made some praiseworthy investigations at the mouth of the Kowak and the entrance of Hotham Inlet. These gave rise to some unfounded reports in the daily press that the river was a new discovery. The extent of the stream, leaving minor curves out of account, cannot much exceed two hundred and fifty geographical miles; but it runs through an almost unknown region, and the official reports will, no doubt, add materially to the geographical knowledge of that part of Alaska.

A trading-post has been established at Yakutat Bay by the Alaska commercial company, — the first which has existed there since the destruction by the Indians of the old Russian settlement of 'New Russia' about eighty years ago. The natives have always been treacherous and unreliable. The establishment will be conveniently situated for any adven-

turous spirits who may attempt the exploration of the St. Elias alps and glaciers.

The last advices from the whaling-fleet announce the taking of a hundred and seventeen whales, which is an unusually successful catch. The steam-whaler Bowhead was crushed in the ice, but without loss of life. The party who intended to winter at Point Barrow, in the signal-station buildings, are reported to have reached their destination after several mishaps.

Brown bears have been unusually numerous and fierce on the Aliaska peninsula this summer, and several salmon-fishers have been attacked: one is reported killed.

Several new canneries have been established, one on Bristol Bay, where four hundred cases of canned and thirty-two hundred and fifty barrels of salted salmon were put up during the season.

At Kadiak the summer had been calm and fine, and the hay-crop a success. At the end of the season several severe gales had occurred. Twenty-one thousand cases of canned salmon had been put up by the two canneries on Kadiak Island.

Two Moravian missionaries entered the Kuskokwim region, and were expecting to winter there among the Innuit tribes. They found their knowledge of the Innuit tongue, gained in Labrador, of much assistance. Letters from them are being printed in the *Moravian*, and contain details of interest.

The vacancy in the church at Unalashka, caused by the recent death of the Rev. Innocentius Shayeshnikoff, has been filled by the transfer of the Greek clergyman at Kadiak to the more western post. Shayeshnikoff was well known to the traders and explorers who have visited the port of Unalashka during the last fifteen years. He was a native Aleut, trained in the colonial seminary, and, for his opportunities, a remarkably well-informed and intelligent man. A pupil of Veniaminoff, he partook of the scientific tastes of his preceptor, was always ready to lend assistance to the explorer, recorded the weather and temperature for many years, and was never happier than when he recounted to some interested listener his observations of natural phenomena, or of the anthropological features of his native region. He will long be regretted, not only by the passing visitor, but by his parishioners, to whom he most faithfully ministered.

The Dominion government, during the past season, has had an explorer investigating the capabilities of the Queen Charlotte Islands for settlement or other purposes. We extract the following notes from his report:—

There are about eighty islands in the group, three of which are of considerable size, the largest having a length of seventy and an extreme width of fifty miles. It is pierced by several remarkable and widely ramifying inlets. Along the western border of the group runs a range of high mountains, whose chief peaks reach four thousand or forty-five hundred feet above the sea, often within a few miles of the sea. The land gradually falls in a series of wave-like hills and rugged valleys toward the north-east, where the largest area of level land occurs. There are about fifty thousand acres of grazing-land on the islands, and a good deal of timber, the best of which is on the shores of Massett Inlet. Many trees were found which measured from thirty to thirty-five feet in circumference. The wood is chiefly spruce (Abies) and yellow Alaskan cedar (Chamaecyparis). The temperature was very even, in midsummer ranging from 50° and 60° in the early morning, to about 70° F. at noon. The rainfall is estimated at from fifty to seventy inches per annum. The snowfall on the coast is not heavy, and remains only a week or ten days on the ground. There are about eight hundred Indians of the Haida nation on the group, who were friendly, and do a brisk business in fish-oil and fish. A fish locally known as the 'black cod,' but which is more like a sea-bass, is extremely numerous: thirty of them will yield a gallon of oil. There are many halibut-banks. Bituminous coal exists, and there is a local deposit of anthracite well known to geologists. Little is known of other minerals. A submerged forest was found, off the coast of Graham Island, covering over fifty acres. Many of the trees were petrified, or converted into lignite. The coast is but little known. Dr. George M. Dawson added greatly to our knowledge of it, in an exploration made a few years since for the Dominion geological survey. In one bay a series of six or eight cataracts was observed, having a combined fall of nearly fifteen hundred feet. Game and wild fowl were tame and very abundant.

THE FLORA OF THE HIGH ALPS.

A RECENT paper on the nival flora of Switzerland, by the late Professor Oswald Heer, shows that 337 species of flowering plants are found in Switzerland between 8,000 and 13,000 feet above the sea. All these species are found between 8,000 and 8,500 feet, probably one-fourth having their greatest distribution above 8,000 feet; while twelve were obtained above 12,000 feet. One tenth comprises species belonging to the lowlands, and nine tenths are mountain plants, the majority belonging to the Alpine region proper. Monte Rosa contains the richest nival flora, although most of the species are distributed through the whole Alpine region.

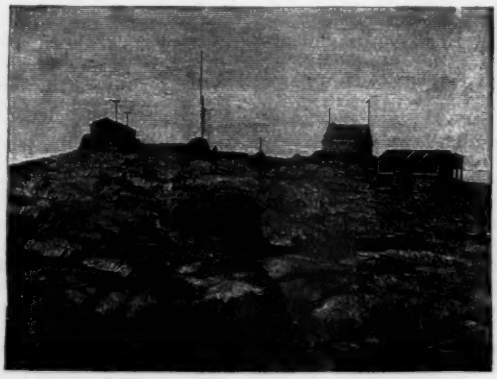
About half of these plants originated in the arctic zone, and apparently came in glacial times from Scandinavia. This arctic flora evidently had its origin on the mountains of the arctic zone, and in miocene times bore the same relation to the flora of the arctic valleys as the present Alpine flora does to the flora of the lowlands of Switzerland. The miocene arctic flora advanced toward Europe as far back as in tertiary times, and in this way the tertiary flora of Europe came into possession of types which now characterize the temperate zone; for instance, the pines and deciduous trees. They gradually gained upon the tropical and subtropical forms, the primitive inhabitants of these regions, and became the parent-plants of a part of the present flora of the lowlands.

In glacial times the mountain plants of the arctic zone descended to the valleys, and were distributed with the glaciers toward the south. That this migration radiated from the north is shown by the fact that not only do arctic species form almost half of the plants in the snowy region of the Alps; but also the mountains of America, as well as of the Altai and Himalayas, possess a large number of arctic forms common also to the Swiss Alps. It is known that in the tertiary and in the upper cretaceous periods a number of species can be traced from Greenland as far as Nebraska in America, and as far as Bohemia and Moravia and southern Europe on the other side. Similarly in the cretaceous period, in the tertiary, and at the present time, Europe and North America have in common a number of species which also existed at that time in the arctic zone, and very evidently had their origin there; and hence the flora of the far north has at all times exerted a great influence on that of Europe.

The endemic flora of the nival region originated in the Alps, especially in the Monte Rosa chain. It possessed its present features at the beginning of the quaternary, and was distributed by means of the glaciers into the valleys and the neighboring mountain regions.

THE DANISH INTERNATIONAL POLAR STATION.

The Danish polar station was at Godthaab, Greenland, — a little colony situated at the extremity of a peninsula which separates the two large parallel fiords, of Godthaab, and that, farther south, of Ameralik. The station was erected on a little hill of almost pure gneiss, twenty-six metres above the level of the surrounding water. This place was chosen both because it was the highest elevation in the immediate neighborhood and because the gneiss appeared free from iron ores.



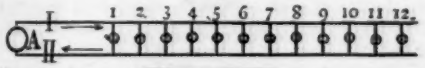
There were, in all, five buildings. The one farthest to the south had two apartments, of which that to the east contained the telescope and the astronomical apparatus. In the other room were a Robinson anemometer and a recording anemoscope. North-east of this building were two for the study of magnetic variations. East of this building was a smaller one for the absolute determination of terrestrial magnetism. The building farthest north was the office; and there the barometers and the Hagemann anemometer were placed, as well as a Mascart electrometer. Besides these, there was in the open space a Wild shelter, covering the thermometers to determine the temperature and humidity of the air, a delicate hygrometer, and a Wild evaporimeter. Three thermometers were placed vertically in holes in the rock, at depths of sixteen, thirty-one, and sixty-three centimetres. At the edge of the holes were small iron pipes to prevent infiltration. The thermometers were sheathed in wooden rods having the same diameter as the holes. At the bottom of each hole was a little mercury, which could penetrate to the thermometer-bulbs through perforations made in the lower part of the rods. Behind the shelter of the thermometers were placed two thermometers whose bulbs were buried fifteen and thirty-seven centimetres respectively beneath the surface of the ground. At some distance from the foot of the hill, two Hamberg thermometers were placed at depths of one metre and one and five-tenths metres. Besides the proposed observations, the parallaxes of a large number of auroras were measured, the electricity of the air was studied, and the temperature of the rocks, the soil, and the water of the fiord, noted.

In the early part of the autumn of 1882 the weather was comparatively mild, south winds prevailing. It was not till the last of September that it was cold enough for a slight frost; but the weather again moderated under the influence of the south winds, which lasted until the first days of October. From the 11th of October the cold was maintained, almost without interruption, until the 5th of March, 1883. During all that interval the thermometer remained constantly below 0° C., except for some isolated days, and then only for a short time. From the 23d of January to the 13th of February the cold was the most intense and persistent; so that even the south winds, and the very low barometrical pressure during that period, were powerless to produce a change. The greatest cold was observed on the 9th of February, with 24°.4 upon a slight elevation; but at the same time it was found to be 26°.7 in the low lands. During the first part of March the cold became again very severe; but after the 5th of the month the weather moderated, and became more variable. It was only after the middle of June that the weather grew milder. In July the heat was normal, and the winds from the south; but by the end of August frost appeared again during the night. The greatest heat of 14°.5 was observed on the 22d of June, during a tempest from the south, at the same time that the thermometer on the low lands attained 17° C.

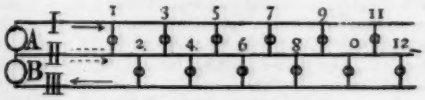
EDISON'S THREE-WIRE SYSTEM OF DISTRIBUTION.

THE three-wire or multiplex system of distributing currents for electric lighting over large areas, as devised and used by Edison, is highly ingenious, and effective in reducing the necessary size of the large copper conductors. The size of the conductor must be proportioned to the maximum number of lamps which it will ordinarily supply. This number being given, the size should be such that the resistance of the metallic part shall bear a fixed ratio to that of the lamp part of the circuit; and the value of this ratio will be determined by the condition that the additional running expense due to the resistance of the conductor shall equal the interest on its first cost, so far as this depends upon its cross-section.

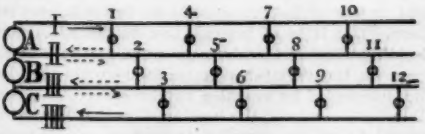
In the two-wire system, *A* is the dynamo, which we will suppose to keep up a difference of potential of a hundred volts between the conductors I and II. Across these are bridged twelve lamps of equal resistance, representing what would be, in practice, several hundred dwellings, factories, churches, theatres, etc.



TWO-WIRE SYSTEM.



THREE-WIRE SYSTEM.



FOUR-WIRE SYSTEM.

The next figure shows Edison's three-wire modification of this. *A* and *B* are two dynamos coupled in series, with conductors I, II, and III leading out as shown. As *A* and *B* each keep up a hundred volts, as before, the difference of potential between I and III will be two hundred volts. The twelve lamps are now, however, equally divided between the circuits I–II and II–III, connected as shown. If the resistance of the six odd-numbered lamps, 1–11, exactly equals that of the six even-numbered, 2–12, and if *A* and *B* keep up the same difference of potential, no current will flow in II, between the dynamos and where the first lamp joins it. Suppose II to be cut, there will then be a single circuit through *A* and *B*, I and III, and the twelve lamps, as shown, with a difference of two hundred volts in I and III. The resistance of the twelve lamps, as now arranged, will be four times what it was before; and hence only one-half as much current will flow through I and III. But each of the lamps will get just as much as before, and will shine the same. The conductors I and III, since the resistance is now four times as great, need only be one-fourth as heavy, according to our adopted principle. This is also proper as regards heating-effect in them, which, proportional to the square of the current, is now only one-fourth what it was before.

If this were all that was needed, we should now have the same amount of lighting done, and the conducting-mains, which are the most expensive part of the plant, of only one-fourth their size and cost in the two-wire system, and with only the additional expense of another dynamo. Moreover, since the current is only one-half as much, these two dynamos, though giving the same potential as before, can be smaller. But on account of the difficulty in keeping an exact balance in the two sets of lamps, especially about the time of lighting up at twilight, it is necessary to introduce the third conductor from between the two dynamos, and then neither circuit can be exposed to a difference of potential greater than either dynamo is generating. Also, if the balance is not kept, a current through II, and a galvanometer, shows on which side the lamp-resistance or the dynamo-potential is in excess; and Edison restores the balance by variable resistances in the circuits of the field-magnets, or, in some cases, by bringing an extra conductor from one or two large buildings, like factories, theatres, etc., when near by, so that they can, at will, be thrown into either circuit from the central station.

This middle wire need not, for most purposes, be so large as the other two; but, in the case of a breakdown of I or III, it will have to do equal work with the other, so that it is safer, simpler, and better to make them all of the same size. The cost, then, of conductors, is that of three wires, each of one-fourth the section of the two in the first case, or $\frac{3}{2} \cdot \frac{1}{4} = .375$, or a saving of sixty-two and a half per cent.

The four-wire system shows a still further reduction of expense. The law on which this percentage of economy proceeds, as far as cost of conductors is concerned, may be shown as follows, in units of the cost of the two-wire system:—

For 2 wires, we have, $\frac{2}{2}(\frac{1}{1})^2 = 1.000$
" 3 " " " $\frac{3}{2}(\frac{1}{2})^2 = .375$
" 4 " " " $\frac{4}{2}(\frac{1}{3})^2 = .222$
" 5 " " " $\frac{5}{2}(\frac{1}{4})^2 = .156$
" 6 " " " $\frac{6}{2}(\frac{1}{5})^2 = .120$

A limit of economy or practicability, however, will soon be reached in the increased number of dynamos, the complexity of the system, and especially in keeping up an approximate balance between so many circuits. In practice, probably, the three-wire system, with its saving of .625 of the cost of the two-wire, will be found all-sufficient; except, perhaps, in the case of a long main through a large scattering district, when the four- or five-wire plan might be preferable.

One other advantage, available in all these systems

over the two-wire plan, is, that if needed for purposes of driving motors, or for large street-lamps of higher resistance, a potential twice as high as the ordinary one is very simply available by connecting across from I to III, or three times as high from I to IV in the four-wire plan, etc.; and, no matter what the amount of such employment, it will not disturb the balance of the intermediate lower potential circuits.

H. M. Paul.

ZOÖLOGICAL RESEARCHES OF THE SCOTTISH FISHERY BOARD.

The Scottish fishery board has for its principal function the administration of public matters relating to the fisheries of Scotland; but since its reconstitution in 1881 it has been endeavoring to perform some of the functions so successfully exercised by the U. S. commission of fish and fisheries. It has recently published its report for the year 1883, the second annual report since its reconstitution. In the general report, a short introduction is followed by a chapter on the herring. The first part of this consists of a summary of inquiries into the natural history of the herring, carried out before the year 1882; to this succeeds a summary of the history and results of similar work done in foreign countries; and, finally, there is an account of the researches undertaken by the board since its reconstitution. The rest of the report is taken up with statistics of the various fisheries, and a few paragraphs on the salmon-fishing.

The remaining and of course much the larger portion of the volume is devoted to the various appendices, in which fuller details are given on matters discussed in the general report. Of these, Appendix F describes the investigations carried out at the instance of the board, while Appendix G is Mr. Young's report on the salmon-fisheries.

The biology of the herring, of course, occupies a prominent place in the volume; and in its discussion there is a tendency to optimistic assumptions, which are not in accord with the true spirit of research. For example: the board, or its scientific committee, proposes in the present autumn to deposit, on some of the inshore banks in the Moray Firth, some millions of fertilized herring-eggs; and then, if next year the said bank is visited by a shoal of comparatively small herring, it will conclude, 1°, that they are the produce of the eggs deposited this year; 2°, that herring, like salmon, when about to spawn, instinctively seek their birthplace; 3°, that the migration of herring is limited, and that, in course of time, special varieties of herring may have been formed at different parts of the coast; and 4°, what is of even more importance, that when any particular spawning-ground is deserted, the fishing may be restored without waiting till accident brings another shoal. Investigation would be a very simple matter, if every experiment were as fruitful in inferences as this. The board will have to prove, in the first place, that the herrings, if it finds them next year, are the produce of the eggs it has laid down. He is a wise herring-breeder that knows his own herrings in the open sea.

Professor Ewart's essay on the natural history of the herring forms No. iv. of this appendix. It is, for the most part, an abstract of a paper read by him before the Royal society of London, on the spawning of the herring, and the examination of a spawning-bed at Ballantrae, on the west coast of Scotland. Professor Ewart observed for the first time the spawning and fertilization of herring-eggs in an aquarium. The process, as he describes it, is probably the same, or nearly, as that which takes place in the sea. But it would have been more satisfactory, if, when he had the opportunity, he had observed the behavior of a number of male and female herrings in the same tank. In his experiment there was but a single female herring. The discussion of other problems connected with the life-history of the herring is not very luminous. The author concludes that herring have come to spawn in spring and autumn because the food of the young fry is more abundant at those seasons than at others; but he has no evidence to show that minute pelagic animals are less abundant at a given place in summer than in spring and autumn. A quantitative investigation of the pelagic life at a given spot throughout the year has not yet been carried out, and such a research would be very valuable.

The report on the sprat-fishing, by Mr. Duncan Matthews, contains a record of much good and interesting work, and raises a question of general interest in marine biology. A certain proportion of young herring are killed with the sprats in the firths of Scotland, and herring-fishers believe that this injures their industry. This contention does not seem very important, after such a season as the last, when herrings were so plentiful off the east coast of Scotland that it was almost impossible to find a market for them. But it is of interest to note the difficulty of deciding whether the abundance of a species depends more on the variations in its food-supply than on the attacks of its enemies, or *vice versa*. It is possible, in the case of the herring, that the destruction caused by all its enemies, including man, is insignificant in comparison to its breeding-powers, and that the number which reaches maturity depends entirely on the amount of food available.

PSEUDO-SCIENCE.

The true theory of the sun. By Thomas Bassnett. New York, *Putnam's*, 1884. 41+263 p., illustr., 1 pl. 8°.

We nowhere find in this volume a systematic attempt to arrive at legitimate deductions from all the collected work of observational astronomy and meteorology; but page after page is devoted to the author's baseless speculations, and to the details of such of his own isolated observations as serve to confirm these speculations, while the labors of others, not condu-

cing to the safety of his hypotheses, are cast aside; as, for example, the well-known work of Carrington on the solar spots, "for the sun was an especial study with him [the author] before Mr. Carrington was born, and he prefers his own approximations" (p. 30).

It is not, however, so hard to see how an ill-balanced enthusiast may persist in this course indefinitely, as it is difficult to conceive of the intellectual stupefaction which busies itself with the preposterous invention of suitable facts to match agreeable hypotheses. When, for example, Mr. Bassnett finds his theory of ethereal vortices cannot help going to pieces when he tries to make it account for the observed phenomena of the periodicity of the solar spots, he has no hesitation in fabricating a great planet outside of Neptune, of such mass, and position, and distance from the sun, as to bring about the absolute harmony of his hypothesis with the observed periodicity; nor does he shrink, when he finds it necessary, to make this convenient planet travel round the sun in just the other way from what all the hitherto recognized planets do.

But unaccountable idiocy can be tolerated where unconscionable conceit cannot. When the world's greatest investigators of solar phenomena confess that the sun and its surroundings are the mystery of cosmical physics, this writer pops into prominent print with a book "whose credentials are an undeniable ability to divest that subject of its mystery." Sun-spots, to say the least, have yielded all their secrets to him; and he retires from an excursion of half a hundred pages on his own theory of the solar spots with a self-complacency more alarming than a thousand eurekas, for he finds that "the solar spots are not such formidable mysteries, after all" (p. 172).

The gross failure of the author's life as a scientific man appears to lie, just where many lives make shipwreck, in his early penetration with the idea that his destiny was with the great. It was for others to drudge in collecting facts, but for him to cut a grand figure in the development of striking and original generalizations,— an unhappy fallacy of ill-balanced minds. 'Our business,' he says, 'is to establish a *theory*,' etc.; and later (p. 129) we are told that "in 1853 the author published the only possible solution of the problem [of sun-spot periodicity]." The persistent refusal of scientific men to recognize his arrogant claims leads him to indulge a vindictive insolence. His experience of the treatment which his theory of electric vortices has received during the past thirty years is a sorry one, and encourages occasional despondency, and the "growing conviction that the scientific world, as a body, loves darkness rather than light." However, he falters not; for it is better to "have the approval of a few kindred spirits, than drift with the current which is sweeping a deluded majority to inevitable oblivion."

How long ought the patience of scientific men to indulge this badgering assumption? Mr. Bassnett has repeatedly addressed himself to the acknowledged leaders in science, and has been just as repeatedly snubbed. At various scientific assemblies he and his ubiquitous electric vortices have been the dread of presiding officers, and the butt of 'Section A.' So far, however, from inculcating the necessity of humility, all these merited rebuffs have only emboldened him to renewed impertinence, which he has the effrontery to term 'scientific spirit.'

A book so nearly valueless we have rarely seen. A single chapter, however, — that on the ethereal medium, — is worth the reading: it is suggestive as to lines of research which may some time come to be worth following out; and the vigorous statements of the author's beliefs are an interesting study. But as a whole, little good, if any, can come from the printing of such a volume; and with equal certainty the harm it can do is a minimum, for its readers will be few, and chiefly confined to such of the curious as know too much to be led astray.

THE VALUE OF SORGHUM.

Sorghum: its culture and manufacture economically considered as a source of sugar, syrup, and fodder. By PETER COLLIER, Ph.D., late chemist of the U. S. department of agriculture. Cincinnati, *Clarke*, 1884. 11+570 p., illustr. 8°.

ALTHOUGH the cultivation of sorghum in the United States, and its utilization as a source of sirup, date from about the middle of this century, and although more or less frequent attempts to produce sugar from it had been made at the time when the U. S. department of agriculture began its investigations (1878), the most conflicting opinions prevailed as to the value of the plant as a source of sugar. The remarkable growth of the sorghum-sugar industry within the last few years, and the very general interest in the subject now manifested, may be fairly ascribed mainly to those investigations, and to others which were incited by them.

It is a matter of congratulation, that the task of recording the results of recent inves-

tigation and experience in this important subject in permanent and accessible form has been assumed by one so competent as the late chemist of the department of agriculture, under whose direction or at whose instigation so much of the work has been done. Dr. Collier's scientific standing, and his thorough knowledge of the sorghum question, will hardly be doubted; and, if at times he betrays the sanguine temper of the enthusiast, the failing is one which leans to virtue's side.

In the book before us we have a very full account of the history of sorghum; a description of its leading varieties, including a table for their identification; and the result of the experience thus far had, relative to the management of the crop and its profitable manufacture. The preparation and manuring of the ground; the selection of suitable varieties; the best methods of planting, cultivating, and harvesting; the effects of climatic conditions; the development of sugar in the plant as related to the proper time for cutting the cane; the operations of milling, defecating, evaporation of the juice, and separation of the sugar; and the utilization of the waste products, — all receive a due share of attention; and the whole constitutes an excellent handbook for the intelligent sugar-maker.

The book, however, is more than a sugar-maker's handbook. One of the most commendable features of the work is the fulness with which the evidence upon each point in turn is laid before the reader, thus enabling him to judge for himself of the value of the conclusions reached. This feature of the volume cannot fail to make it of great value to all who are engaged in investigations in this direction; for, not only are the results thus far obtained given with much fulness, but the author is as careful to exhibit our ignorance as our knowledge, and does not fail to point out the directions in which further investigations are needful.

That the latter are numerous need hardly be said. In spite of the great amount of work which this book records, or refers to, much yet remains to be done to render this industry an assured success. Indeed, to us the need of more knowledge is really the most striking conclusion to be drawn from a study of what is already known. Particularly is this the case with regard to the economies of sugar-making, where a wide field is open to investigation. If Dr. Collier's volume shall prove an incitement and aid to the acquisition of more light upon these and other points, as well as be of use to the practical sugar-maker, he may account it as in the best sense a success.

NOTES AND NEWS.

The library of the late Professor Henry has been purchased from his heirs by Dr. A. Graham Bell. It contains about two thousand volumes, at least one-third of which treat of electrical science, and many of these bear marginal notes in the handwriting of Professor Henry. One of the terms of the sale was that the library should be kept intact.

— The Norwegian bark Loveid, recently arrived in Philadelphia, reports a very peculiar squall experienced Oct. 18, in latitude 39° 49′ north, longitude 69° 5′ west. During fine, clear weather, with a light breeze from the north-west, heavy banks of clouds of most threatening aspect suddenly appeared, driving in every direction. Almost immediately a heavy squall of wind and rain struck the vessel, the wind shifting quickly all around the compass. In the midst of this disturbance, which lasted about an hour, a single peal of thunder was heard, and simultaneously a bolt of lightning struck the fore royal mast-head, and ran down the mast to the royal yard, which was almost destroyed. The lightning, which looked like a ball of fire, then ran out on the horn of the cross-trees, and 'burst' with a loud report, scattering sparks all over the vessel. The barometer fell suddenly from 30 to 28.60, and then rose as rapidly, the weather becoming pleasant immediately afterwards. This is a rather peculiar squall, considering the locality and the season.

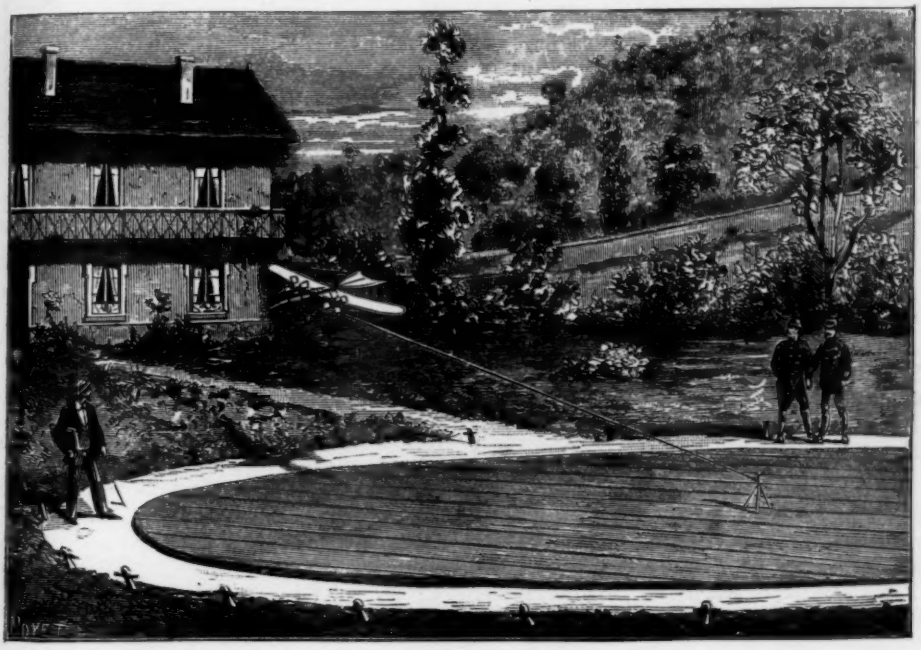
— The monthly weather-review of the signal-service, prepared, as announced for the first time in the August number, by Second Lieut. W. A. Glassford, has come to be a quarto of twenty-eight pages, with five charts. This is a good growth from the four small pages and three charts of the first issue, eleven years ago. Then, the headings were storms, anti-cyclonic areas, temperature, precipitation, peculiar phenomena and facts, rivers, and cautionary signals: now, all these subjects are treated in much greater detail; and among the many additional topics there may be mentioned atmospheric pressure and its range (illustrated by a new style of chart), Atlantic storms and ice, range of temperature, frosts (illustrated by a chart for Aug. 9 and 25), winds, local storms, tornadoes and thunder-storms, sunsets, drought, two and a half pages on the earthquake of Aug. 10, meteors, and notes of state weather-services for Alabama, Nebraska, Tennessee, Missouri, Louisiana, Ohio, and Georgia. The storm-tracks for the month are remarkably regular, and, with insignificant exceptions, all lie north of the Great Lakes and St. Lawrence: no tropical cyclones were felt along the seacoast. Nine tornadoes are reported, and many violent thunder-storms. Some of the results of the special studies of the latter, undertaken by Mr. H. A. Hazen during the past season, take form in a brief summary, from which it appears that the mean distance and direction of the nine hundred thunder-storms recorded in August, from the centre of the broad cyclonic storms in which they occurred, was five hundred and fifteen miles, a little west of south. A full account of these studies will be of much value

and interest. Most of the observations on meteors are of small value; and, at best, they have but an etymological connection with a weather-review.

— The fish-commission steamer Albatross will spend the winter in the Gulf of Mexico. A special study will be made of the waters in and about Mobile Bay, where, during the past few years, a strange and as yet unknown malady has poisoned the fish so as to render them unfit for food; but the larger part of the cruise is to be spent along the coast of Texas and Louisiana.

The exact days and place of meeting will be announced later. Titles of papers to be read, and nominations of candidates for election, should be sent to the secretary at once.

— Bulletin No. 5 of the U. S. geological survey is a dictionary of altitudes in the United States, compiled by Henry Gannett, chief geographer of the survey. It is essentially an extension of the 'Lists of elevations,' prepared by the same author for Hayden's survey; but, with the present broader organization of the geological survey, the lists now appropriately include the whole country, while the earlier editions were concerned chiefly with the region west of the Mississippi. A list of authorities fills eight pages, and railroad abbreviations occupy eight more; then the states and stations follow alphabetically, the number of altitudes given being about eighteen thousand. It is stated that the collection of railroad profiles for Pennsylvania is exceptionally complete and admirably adjusted, making the portion of the dictionary referring to that state by far the fullest and most satisfactory. By apparent oversight, it is not stated whether the base level is high, mean, or low tide.



EXPERIMENT WITH THE AEROPLANE MADE AT THE FRENCH MILITARY EXPERIMENT-STATION OF CHALAIS-MEUDON IN 1879. (*La Nature.*)

— The announcement is made, that copies in bronze of a bust of the late J. B. Dumas of Paris, may be obtained by subscription, addressed to the administration of the Génie civil, Paris. The original bust was executed by Guillaume, of the Institut, and was pronounced highly satisfactory. The prices range from sixty francs to six hundred francs, according to size and quality of the bronze.

— Phylloxera has made its appearance in the Pomological institute of Proskau (Silesia). It is hoped, however, that the spread of the disease may yet be prevented.

— The next meeting of the Society of naturalists of the eastern United States will be held at Washington during the week following Christmas, 1884.

— Two volumes of the addresses and speeches of Helmholtz have just been published in Germany.

A third edition of his well-known volume, entitled 'Popular scientific addresses,' having been called for, the author seized the opportunity to complete the collections, and in doing so has dropped the word 'popular,' although the earlier and later papers are alike designed to bring the results of mathematical, physical, and other scientific researches, before a circle of hearers and readers whose studies do not run in that direction. Among other papers, the volumes contain Helmholtz's prefaces to the German edition of Thomson and Tait's 'Natural philosophy,' and of Tyndall's 'Fragments of science,' and also his academic discourses. Among other noteworthy papers is an address on electrical units in reference to the action of the Electrical congress at Paris in 1881. This address, which was given in Berlin in December of that year, was reported, at the time of its delivery, stenographically, and has now been revised, and supplemented by a statement of the conclusions of the conference of 1884.

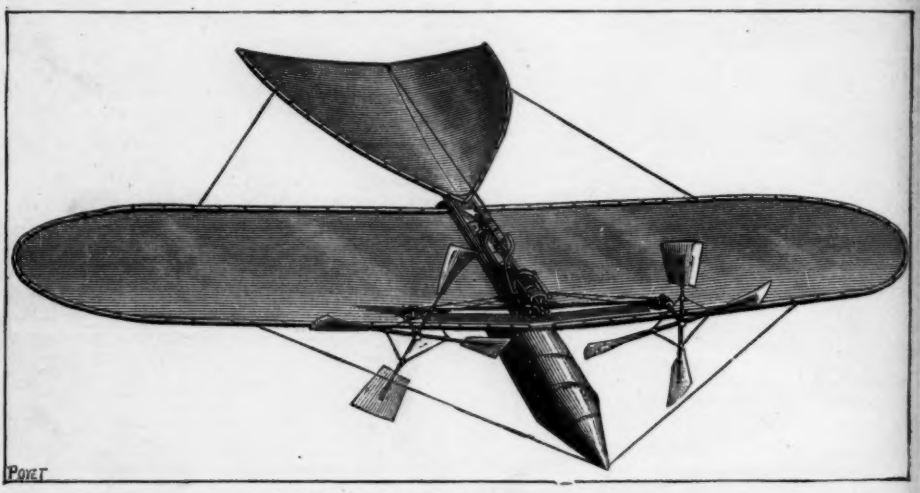
— Professor Valentine Ball of Dublin writes to *Nature*, lamenting the few copies of the English government scientific reports which are gratuitously distributed in the United States. He states, that although from a feeling of shame he did not seek to gather statistics, he found from casual conversation that a great many of the American libraries were obliged to purchase such reports as those of the various English surveys and the Challenger expedition. He praises the lavishness of our own government bureaus and the work of the Smithsonian in the distribution of printed matter, and expresses a hope that some similar free bureau of exchange may be established in England.

— Prof. F. Braun, formerly at the Polytechnikum in Carlsruhe, has been called to the professorship of physics at Tübingen. Dr. O. Lüdecke has been appointed professor in the philosophical faculty in the university at Halle.

— The German association of naturalists has selected Strassburg for its next year's assembly.

— The completion of the Lick observatory now depends upon the successful making of the disk of glass for the objective of the large telescope. The main dome cannot be made till the focal length of the large equatorial has been determined.

— The success of the flying-machine invented by Renard and Krebs has called attention to a partially successful experiment tried at the military experiment-station at Chalais-Meudon in 1879. The construction of the machine, an invention of Victor Tatin, is pictured in a general way above. It consisted of a cylindrical receiver for compressed air, which was used to drive two air-propellers. The weight of the whole was supported by the pressure of the air against the under sides of the laterally extended wings, the forward edges of which were kept inclined slightly up by the steering-action of the tail. The total weight of the apparatus, as tried, was 1.75 kilograms, and the velocity obtained, about 8 metres per second. The machine was able to rise from the ground; and, attached by a cord to a post, it flew around in a circle, passing over the head of the spectator (see p. 481). Mr. Tatin sent a description of his experiments to the French académie des sciences, in competition for the Perraud prize, and received a reward, as did Gaston Tissandier for his experiments on the application of electricity to aeronautics, and Duroy de Bruignac for his *aérophone mixte*.



AEROPLANE INVENTED BY VICTOR TATIN. (*La Nature.*)